What is Claimed Is:

1. A method for detecting or quantifying a target nucleic acid in a sample comprising:

(a) preparing a primer or primers specifically matched to a predetermined position of the target nucleic acid;

(b) annealing the primer or primers from (a) with the target nucleic acid under high stringency conditions to obtain a primer-nucleic acid duplex at the predetermined position of the target nucleic acid;

(c) mixing the primer-nucleic acid duplex from (b) with a mixture comprising:

(1) one or two or three types of free non-terminator nucleotides and at least one type of non-terminator nucleotide that is optionally labeled with a detectable marker, and

(2) with or without a type of terminator nucleotide that is different from the one or two or three types of non-terminator nucleotides in (1);

(d) performing the primer extension by enzymatic or chemical reaction in an appropriate buffer; and

(e) detecting or quantifying the amount of labeling signal on the primer extended nucleotides, or

(f) detecting or quantifying the amount of extended primers by mass spectrometry.

2. The method according to claim 1, wherein the primer is a nucleic acid primer, an oligodeoxyribonucleotide, an oligoribonucleotide, or a copolymer of deoxyribonucleic acid and ribonucleic acid.

3. The method according to claim 1, wherein the nucleic acid of interest is a deoxyribonucleic acid, a ribonucleic acid, or a copolymer of deoxyribonucleic acid and ribonucleic acid.

4. The method according to claim 1, wherein the non-terminator nucleotide is deoxyribonucleotide or ribonucleotide.

5. The method according to claim 1, wherein the terminator is dideoxyribonucleotide.

6. The method according to claim 1, wherein a combination of non-terminator and terminator nucleotide mix is:

(a) dATP, dCTP, dGTP, ddTTP or ddUTP,
(b) dATP, dCTP, dTTP or dUTP, ddGTP,
(c) dATP, dGTP, dTTP or dUTP, ddCTP,
(d) dCTP, dGTP, dTTP, or dUTP, ddATP,
(e) dATP, dCTP, dGTP,
(f) dATP, dCTP, dTTP or dUTP,
(g) dATP, dGTP, dTTP or dUTP, or
(h) dCTP, dGTP, dTTP or dUTP.

7. The method according to claim 1, wherein at least one non-terminator nucleotide is labeled with a detectable marker.

8. The method according to claim 1, wherein the terminator nucleotide is labeled with or without a detectable marker that is different from the marker labeled with non-terminator nucleotides.

9. The method according to claim 7 or 8, wherein said detectable marker comprises an enzyme or protein moiety, radioactive isotope, a fluorescent moiety or a chemical group.

10. The method according to claim 1, wherein said non-terminator and terminator nucleotides are unlabeled and detecting or quantifying step is carried out by analyzing amount of extended primers using mass spectrometry.

11. The method according to claim 1, wherein said enzyme is template-dependent.

12. The method according to claim 11, wherein the template-dependent enzyme is DNA polymerase, RNA polymerase or reverse transcriptase.

13. The method according to claim 12, wherein the template-dependent enzyme is *E. coli* DNA polymerase I, a Klenow fragment thereof, T4 DNA polymerase, T7 DNA polymerase, Thermophilic DNA polymerase, retroviral reverse transcriptase, or a combination thereof.

14. The method according to claim 1, wherein the target nucleic acid is synthesized enzymatically *in vivo*, *in vitro*, or synthesized non-enzymatically.

15. The method according to claim 1, wherein the target nucleic acid is synthesized by polymerase chain reaction.

16. The method according to claim 1, wherein the target nucleic acid comprises non-natural nucleotide analogs.

17. The method according to claim 16, wherein the non-natural nucleotide analogs comprise deoxyinosine or 7-deaza-2'-deoxyguanosine.

18. The method according to claim 1, wherein the target nucleic acid comprises genomic DNA from an organism, RNA transcripts thereof, or cDNA prepared from RNA transcripts thereof.

19. The method according to claim 18, wherein the organism is a plant, microorganism, bacteria, virus.

20. The method according to claim 18, wherein the organism is a vertebrate or invertebrate.

21. The method according to claim 18, wherein the organism is a mammal.

22. The method according to claim 21, wherein the organism is a human being.

23. The method according to claim 1, wherein an amplification step is performed on the target nucleic acid.

24. The method according to claim 23, wherein the amplification step comprises cloning, transcription, polymerase chain reaction (PCR), ligase chain reaction (LCR), strand displacement amplification (SDA), or loop mediated isothermal amplification (LAMP).

25. The method according to claim 1, wherein the primer comprises one or more moieties that permit affinity separation of the primer from the unincorporated reagent and/or the nucleic acid of interest.

26. The method according to claim 1, wherein the primer comprises one or more moieties that allows immobilization of primer onto a solid support to produce an immobilized primer sequence.

27. The method according to claim 25 or 26, wherein the moieties comprises a special chemical groups such as biotin or digitonin.

28. The method according to claim 25 or 26, wherein the moieties comprises a DNA or RNA sequence that allows the primer to link to a solid support via base pairing to a complementary sequence present in solid support.

29. The method according to claim 1, wherein the primer is directly synthesized on a solid support to produce an immobilized primer sequence.

30. The method according to claim 29, wherein the synthesis is accomplished by enzymatic or chemical or physical method.

31. The method according to claim 1, the primer is immobilized onto a solid support to produce an immobilized target nucleic acid sequence.

32. The method according to claim 1, wherein the primer is reversibly immobilized on to a solid support.

33. The method according to claim 32, wherein the primer can be cleaved from the solid support by a chemical, enzymatic or physical process.

34. The method according to claim 1, wherein the target nucleic acid is immobilized onto a solid support to produce an immobilized target nucleic acid sequence.

35. The method according to claim 1, wherein the target nucleic acid is reversibly immobilized onto a solid support.

36. The method according to claim 34, wherein the target nucleic acid can be cleaved from the solid support by a chemical, enzymatic or physical process.

37. The method according to claim 31, 32, 34 or 35,, wherein immobilization is accomplished via a photocleavable bond.

38. The method according to claim 26, 28, 29, 31, 32, 34 or 35, wherein the solid support comprises beads, flat surfaces, chips, capillaries, pins, combs or wafers.

39. The method according to claim 31, 32, 34 or 35, wherein said immobilization is accomplished by hybridization between a complementary capture nucleic acid molecule, which has been previously immobilized to a solid support, and a portion of the nucleic acid molecule, which is distinct from the target nucleic acid sequence.

40. The method according to claim 31, 32, 34 or 35, wherein said immobilization is accomplished via direct bonding between the solid support and a portion of the nucleic acid molecule, which is distinct from the target nucleic acid sequence.